

Running head: DEPLOYED WARRIOR MEDICAL MANAGEMENT CENTER

Analyzing the Requirement for a
Deployed Warrior Medical Management Center
Table of Distribution and Allowances at
Landstuhl Regional Medical Center

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Abstract

This study identified personnel, equipment, facilities, evacuation, time, and patient acuity variables within the Department of Defense Central and European Commands as they pertained to the development of a Separate Table of Distribution and Allowances organization designed to medically manage evacuees during war. Three separate analyses were conducted to gather the results. A qualitative historical analysis of the existing Deployed Warrior Medical Management Center at Landstuhl Regional Medical Center revealed the need for various operational cells for the management of inpatients versus outpatients. A Chi-Square statistical test using a cross tabulation table with an alpha probability set at $p = .01$ was predictive of the type of patient diagnosis (identified by ICD9 Codes) during the first 180 days of Operation Iraqi Freedom. A total cost analysis identified patterns of financial expense, which suggested that evacuation for treatment at Landstuhl Regional Medical Center was more costly than treatment in the Central Command Theater of operations. The results of these three separate analyses support the need for a separate Table of Distribution and Allowances organization under Landstuhl Regional Medical Center dedicated to the management of evacuees during times of war and provide a template for further evaluation and planning for such an organization.

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Analyzing the Requirement for a Deployed Warrior Medical
Management Center Table of Distribution and Allowances at
Landstuhl Regional Medical Center

Introduction

Conditions Which Prompted the Study:

Landstuhl Regional Medical Center serves as America's beacon of health care for its sons and daughters abroad, and is therefore the primary fixed medical facility receiving Coalition Forces evacuated from the European and Central Command theaters. The hospital is staffed with approximately 474 clinical providers, 275 nurses, 40 Medical Service Corps officers, 700 enlisted personnel, and 775 civilian employees. Of the military personnel assigned, roughly 75 percent are Army and 25 percent are Air Force. Service members in need of primary and tertiary medical care services not provided in combat zones or hazardous duty areas in Afghanistan, Iraq, the Balkans and Africa, are evacuated to Landstuhl Regional Medical Center, daily. Central Command alone currently sends approximately 40 patients per day to Landstuhl Regional Medical Center. The medical care for these evacuated service members must be closely managed to assure world-class support for America's greatest asset and to preserve the quality of care Landstuhl Regional Medical Center's remaining 300,000 beneficiaries have come to expect.

Coalition forces needing more comprehensive care than is provided by the Forward Surgical Teams and Combat Support Hospitals in Iraq and Afghanistan are evacuated out of Central Command directly to Landstuhl Regional Medical Center for

treatment and Return to Duty or movement to the Continental United States. The U.S. Air Force manages the theater aeromedical evacuation process for personnel in the Central Command area of operations using its Joint Patient Movement Requirements Center. This activity coordinates with the European Command's Theater Patient Movement Requirements Center-Europe when evacuating its patients to the Ramstein Air Force Base Aeromedical Staging Facility in Germany prior to ground or helicopter movement to Landstuhl Regional Medical Center.

Triage experts, patient administration, and air evacuation personnel at Landstuhl Regional Medical Center communicate with all three of these Air Force elements during the evacuation process to help determine the patient's requirement for further medical care and to trace patient movement. The Transportation Command's Regulating and Command and Control Evacuation System make this joint visibility possible for the Air Force evacuation elements and Landstuhl Regional Medical Center. Born out of necessity from Operation Desert Storm, this system combines transportation and clinical decision elements into a seamless evacuation information system that distributes pertinent data in order to deliver patients efficiently.

This seemingly precise evacuation process from the Global War on Terrorism frontlines to the emergency room at Landstuhl Regional Medical Center was largely untaught until Operations Enduring and Iraqi Freedom were launched. While the processes involved with moving patients out of and into the theater of operations were well-grounded in doctrine and proven by joint

operations in the Balkans, the staffing and facilities needed to perform these processes for larger and consecutive operations such as Operation Enduring Freedom and Operation Iraqi Freedom were not established at the hospital. Rather, they were formed hastily in response to an overwhelming demand placed on our Military Health System.

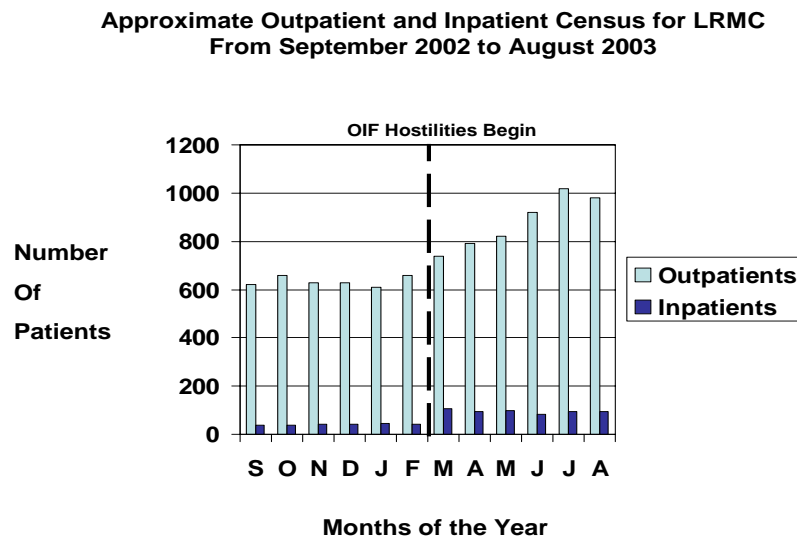
In receiving a daily average of 40 patients from the frontlines with a subsequent movement to the Continental United States or Return to Duty, Landstuhl Regional Medical Center has faced a mass casualty-type experience on an almost daily basis since March of 2003. Moreover, the patient's needs are not limited to medical treatment. Coalition patients from Operation Enduring Freedom and Operation Iraqi Freedom as well as the Balkans have a myriad of medical, administrative and personal requirements that must be managed from their point of injury or illness to their Return to Duty or movement to the Continental United States. This is especially true for outpatients.

Therefore, in addition to serving as a Center of Excellence for medical treatment, needs assessment, care coordination, and case management, Landstuhl Regional Medical Center became by default the focal point for outpatient screening, tracking, billeting, boarding, clothing allotment, personal baggage storage, travel assistance, concierge-type service for coalition member needs, public affairs assistance, and information provision.

In response to these additional demands, Landstuhl Regional Medical Center assessed the staffing, equipment and facility

requirements necessary to successfully control and manage roughly another 250 outpatients and 50 inpatients on any given day. As seen below (Figure 1), the average number of inpatients at Landstuhl Regional Medical Center was approximately 40 on any given day prior to the start of hostilities in Iraq. Outpatients averaged 660 on any given day.

Figure 1



The activity created as a result of Landstuhl's influx of evacuated patients from Operations Enduring and Iraqi Freedom is now called the Deployed Warrior Medical Management Center. Initially established in June of 2002 to manage evacuees from Operation Enduring Freedom, this fledgling organization used existing hospital space and approximately 20 key administrative and case management personnel to focus on medically managing patients from the Global War on Terrorism. Today, the Deployed Warrior Medical Management Center operates 24 hours a day, seven days a week. It is housed in long-term metal structures placed

in a parking lot adjacent to the Landstuhl Regional Medical Center emergency room entrance and in barracks located approximately 25 kilometers east of the hospital on a separate installation. It is equipped with automation connected to the local area network and manned with approximately 101 active duty Army and Air Force (permanent party and augmented), civilian service members, and backfill Army Reserve personnel from the 94th General Hospital. Approximately 20 percent of the Deployed Warrior Medical Management Center's 101 personnel are borrowed from Landstuhl Regional Medical Center.

Statement of the Problem or Question:

Medically managing our evacuated forces without disrupting continued support for our beneficiaries existing overseas is essential to the quality of care for the entire Military Health System. In fact, the medical management of our deployed warriors and existing patient base overseas is frequently the only lasting perception a person takes from the Military Healthcare System. After all, there are healthcare alternatives for our military beneficiaries living in the United States. Such is never the case when deployed to a combat zone or hazardous duty area, and rarely the case even when stationed in a peaceful area outside the Continental United States. Duty overseas, particularly in Europe, Africa and Southwest Asia, is more dangerous than ever due to the Global War on Terrorism. Therefore, because our beneficiaries overseas are more prone to a need for healthcare and are significantly limited in their alternatives (frequently having none at all), there is, perhaps,

a moral obligation to dedicate added resources to the medical management of these deployed warriors, their families and retirees. The following is the main question this research hopes to answer: Does the Department of Defense need to establish a separate Table of Distribution and Allowances organization resembling the current Deployed Warrior Medical Management Center at Landstuhl Regional Medical Center to maintain our Military Healthcare System's quality of care overseas while fighting the Global War on Terrorism?

Literature Review:

The concept of a Deployed Warrior Medical Management Center is new, and therefore, literature speaking directly about such an organization is limited. However, the functions performed by the Deployed Warrior Medical Management Center, such as the administrative management of healthcare and patient movement, have been the subject of extensive research in all branches of military service and civilian healthcare. Additionally, the medical management of patients during war has been well documented throughout our national history as well as the need to establish Table of Distribution and Allowances organizations from time to time to perform specific missions for which there are no appropriate Table of Organization and Equipment units. Therefore, while virtually no literature exists discussing specific organizations such as a Deployed Warrior Medical Management Center, there is an abundance of literature discussing the importance of organizations responsible for the medical management and evacuation of patients.

Medically managing patients during all facets of the evacuation process is paramount to quality healthcare. Driscoll (2001) claimed that medical evacuation is taken for granted in today's military. For example, he noted the use of helicopters during the Korean War for evacuation purposes reportedly established an exceptionally low wounded mortality rate of 2.4 percent. In the course of the war, helicopters evacuated roughly 22,000 patients over the rugged Korean peninsula. This was perhaps the birth of rapid patient movement from the battlefield, and was impressive in its time. However, as time passed, the need to closely manage and administratively improve the evacuation process became clear.

More recently, during the initial assaults of Operation Enduring Freedom, the two surgical teams at Camp Rhino treated 46 casualties within six weeks due to blast or blunt injury (Bilski et al., 2003). The biggest problem faced by these teams was delayed access to initial and follow-on surgical care due to long evacuation transport times. They claimed that better joint evacuation operations could have been planned between services. Wood, Scally and O'Neill (1995) support this claim as well, stating there is a definite need to further develop medical administration between allied forces during war. Their research suggests that organizations dedicated to the accurate accounting and transporting of patients are vital. Szilard, Cserti, Hoxha and Gorbacheva (2002) claimed that strong medical management processes undoubtedly contribute to the saving of lives. They assert the medical management processes observed while

evacuating patients during the conflict in the Balkans accounted for the successful movement of over 1,000 medical cases for treatment across 25 host countries throughout the world.

The need for administratively sound evacuation procedures is present throughout civilian health systems as well. Schultz, Koenig, and Lewis (2003) claim that during an earthquake in 1994 in Northridge, California, several hospitals were forced to evacuate patients over great distances. They examined the various methods of evacuation and administrative management strategies used by several of the hospitals in California affected by the earthquake, and concluded that hospital leaders should build response teams in preparation for major disasters, which include acts of terrorism. Their study suggested the evacuation of large numbers of patients from multiple locations can be accomplished quickly and safely if resources and personnel are committed to this effort.

Rosenberg, Butz and Comstock (2003) also claimed that dedicated units must manage civilian aeromedical evacuation services closely. They contended such services are extremely important but poorly understood. While flight evacuation is a critically important aspect of patient care, the lack of proper medical management during evacuation (such as proper registration at each juncture) can result in tragedy.

Lane and Ross (1998) contend that not only must administrators have tracking and physical movement systems in place, but care providers themselves must be willing to assume a high level of responsibility for administratively managing the

healthcare of their patients. However, they concluded that since most care providers receive no formal training in medical administration and management, hospital leaders should assign appropriate levels of administrative support to meet these requirements.

Chernof, Hilborne, Heckman, Esquivel and Guterman (1995) support the contentions made by Lane and Ross (1998) by asserting that pathologists, for instance, are positioned to play a key role in medical management at their institutions. They claim that laboratory medical specialists will need expertise in data management and administrative improvement in the future in order to successfully track and manage patients during movement.

Beyond patient tracking during evacuation and the importance of combining strong administrative processes with healthcare provider involvement, there is literature suggesting that better deployment screening techniques combined with positioning medical equipment far forward can reduce the number of patients being transported for care, thereby reducing a hospital's medical management workload. For instance, Lukish, Gill and McCoy (2001) claimed that isolated military hospitals maintain the health of service members throughout the world, and they should be made capable of providing more advanced surgical care. Their study suggests general and orthopedic surgery at an isolated hospital can be provided within the standard of care. Additionally, Newmark and France (1998) observed a six-month rotation in Saudi Arabia described as a Military Operation Other

Than War and concluded even a healthy Army population requires a full panel of medical specialties as far forward as possible. They asserted planners should include these needs in their estimations.

Considering the value of proper medical screening prior to deployment in order to minimize patient evacuation, Adams (1996) noted that the British Army assigned to the Balkans made the observations that 41 percent of its patients were being repatriated for pre-existing disease or injury and that 78 percent of these cases were known to the soldier's medical officer. Despite this, they were allowed to deploy, causing undue stress on the medical evacuation system. He concluded that medical officers should be more diligent in downgrading unfit personnel to prevent their deployment, thereby reducing the burden on the medical evacuation chain.

But regardless of the causes for having to move a patient, the flow and reception processes for evacuees are critical to medical care. Every step should be taken to assure quality medical management occurs at this point. One suggested improvement comes from an anonymous (2002) author who claimed that patient flow could be dramatically improved with electronic patient tracking systems that give information in real time. Such systems can provide immediate information about case management and lab results, for example. Bouman, Schouwerwou, Van der Eijk, Van Leusden, and Savelkoul (2000) support this suggestion, claiming the admission of a large number of victims during a mass casualty can lead to chaos and disruption of the

hospital's regular organization. They state that ending chaos quickly is dependent on proper registration techniques and the overview of patients already registered. According to their research, a computer system employing bar codes to track patients is helpful, and fewer registration errors occur when an automated system is used as opposed to a manual registration system.

Purpose:

The primary purpose of this research was to provide evidence regarding patient volume, acuity, and cost to the Landstuhl Regional Medical Center Commander to either support or refuted the need for a separate Table of Distribution and Allowances organization resembling the current Deployed Warrior Medical Management Center. The secondary purpose was to assist in the development of a Deployed Warrior Medical Management Center Table of Distribution and Allowances for the Landstuhl Regional Medical Center Commander if such a need did in fact exist. This would provide a positive impact on the Army's continuing efforts to improve medical management.

Some of the variables this project addressed were used to determine the levels of personnel, equipment and facilities necessary for a potential Table of Distribution and Allowances organization to function during the different phases of the Global War on Terrorism. For example, the initial surge of evacuees during the first phase of Operation Iraqi Freedom consisted of an equal amount of inpatients and outpatients, while subsequent phases saw inpatient levels decrease and

outpatient levels increase dramatically (Figures 2 and 3).

Figure 2

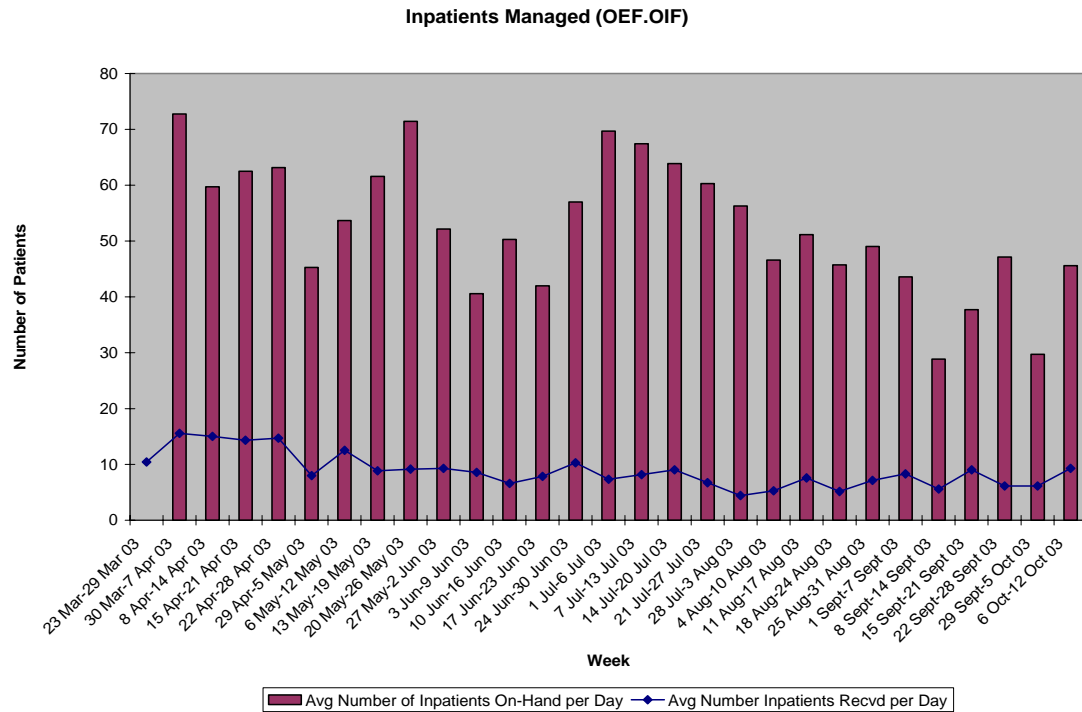
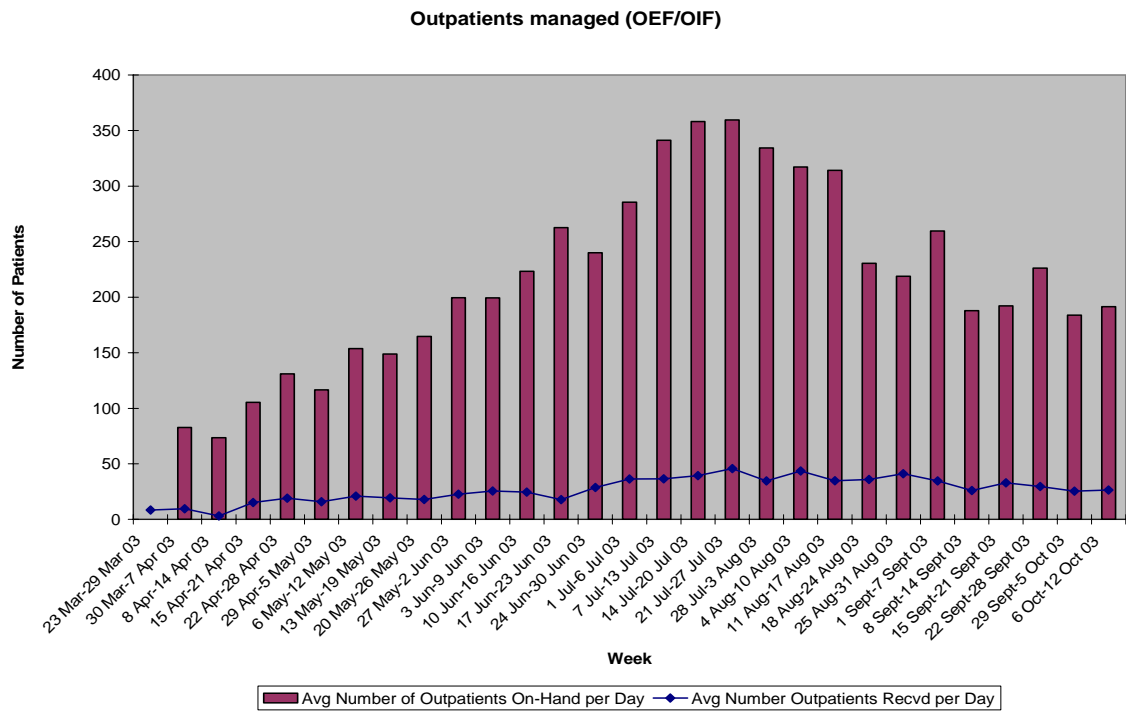


Figure 3



This data suggested the need for a scalable Table of

Distribution and Allowances that could be molded to fit the different phases of operations in the Global War on Terrorism and the resulting fluctuation in inpatient versus outpatient treatment.

Further, some of the data compared the benefits of evacuating patients with higher medical needs to treating these patients in the Central Command area of operations by pushing key assets forward. For some types of treatment, there was evidence suggesting that pushing resources forward was cost-effective, which would result in a more modest Table of Distribution and Allowances for support of evacuees at Landstuhl Regional Medical Center.

Primary and Secondary Hypothesis:

The primary hypothesis was that as the months progressed during Operation Iraqi Freedom, changes occurred in the types of patients evacuated to Landstuhl Regional Medical Center. The secondary hypothesis was that enhancing the care in Central Command to treat the most frequently occurring patient diagnoses in theater is less costly than evacuating those patients to Landstuhl Regional Medical Center. The findings from both the primary and secondary hypotheses directly impacted the potential equipment and personnel levels necessary to build a Table of Distribution and Allowances organization in support of evacuation processes at Landstuhl, which was the purpose of this research. The evidence taken from these two hypotheses provided the analysis and met the primary and secondary purposes of this research.

Method and Procedures

For the primary and secondary hypotheses, the research subjects were the patients evacuated to Landstuhl Regional Medical Center within the first six months of Operation Iraqi Freedom during 2003 (from March to August). The actual number of evacuees and their primary diagnosis (identified using the ICD9 Codes) were gathered from the hospital Composite Healthcare System database and were checked for reliability using the Transportation Command's Regulating and Command and Control Evacuation System database, and the Deployed Warrior Medical Management Center's local Access database.

The data was considered reliable due to being gathered retrospectively from three separate systems and compared for variances. The hospital Composite Healthcare System data was input by care providers when an actual inpatient or outpatient was physically present at Landstuhl Regional Medical Center for treatment, and was used to continually monitor and report the case progress. The data were not based on projections or secondary reporting, so error was minimized. The Composite Healthcare System data was therefore considered valid due to its continuous review by case managers, physicians, nurses, and support staff. These personnel ensure that it measures what it is supposed to measure.

This research project used both qualitative and quantitative analyses to test the primary and secondary hypotheses, and both hypotheses were used to support the primary and secondary purposes. For the first hypothesis, a qualitative

observational study was conducted by reviewing the historical accounts of personnel between March and August of 2003 working within the Deployed Warrior Medical Management Center. This historical record was useful in determining the various types operational cells, level of staffing within each cell, and the equipment and facilities necessary to manage patients diagnosed with inpatient ICD9 Codes versus patients diagnosed with outpatient ICD9 Codes during the height of the war. The intent of this portion of the project was to help determine whether or not the level of Deployed Warrior Medical Management Center resources necessary to manage evacuees depended on the patient's ICD9 Code during the beginning of Operation Iraqi Freedom.

The historical accounting of personnel time and motion within each of the separate cells identified was used to determine how many man hours were necessary for each cell to support 47 new patients per day, which was the average number of patients arriving every 24 hours during the first six months of Operation Iraqi Freedom. The man hours were then used to determine how many individual staff members working in eight-hour shifts were necessary to support the same number of evacuees for a one-day period (all man hour fractions were rounded up to account for one human being). Staff members were identified as Officer, Non-Commissioned Officer, Specialist, Registered Nurse, or Medical Doctor. The reader should note that the Registered Nurses and Medical Doctors are not necessarily military personnel. The number of individual staff members was then used to determine the level of office equipment

(e.g. computers, printers, file cabinets, desks, chairs) and temporary metal office containers necessary to support the same. Once the level of resources was identified for each operating cell, this research determined which cells were necessary to manage patients diagnosed with inpatient or outpatient ICD9 Codes, and which cells managed strictly patients diagnosed with outpatient ICD9 Codes. The reader should understand the results do not reflect the personnel necessary to administer the Deployed Warrior Medical Management Center for an extended period of time. These numbers are merely the personnel necessary to manage operations for one day and are only meant to help determine required resource levels as they pertain to ICD9 Code diagnoses.

Then quantitatively, this research conducted a Chi-Square test using a contingency table in order to display each classification of the months and ICD9 Codes being studied. The intent was to determine if these two variables were independent. The ICD9 Codes made up the rows and the months made up the columns (Table 1). Where these two variables intersect are cells that determine whether or not the data are classified independently. The sample data items were selected from the top five most frequently occurring ICD9 codes for inpatients and outpatients during the first six months of Operation Iraqi Freedom. Each cell has a minimum expected frequency of five. A standard seven-step method was used to conduct the first quantitative analysis.

Table 1

ICD9 Codes by Months Cross Tabulation

Count		Month						Total
		March	April	May	June	July	August	
Icds	309.0	1	4	5	12	5	5	32
	550.90	0	1	8	4	15	21	49
	592.1	0	4	9	11	11	13	48
	786.59	2	10	12	9	9	10	52
	V57.1	26	118	71	64	66	71	416
	V57.21	4	27	16	7	25	30	109
	V58.43	7	25	8	7	0	2	49
	V70.5	7	17	2	7	358	18	409
	V70.50	6	50	52	6	139	146	399
	V70.56	0	43	113	569	263	32	1020
Total		53	299	296	696	891	348	2583

To test the secondary hypothesis, this research conducted quantitative cost analyses on the five most common types of ICD9 Codes for both outpatients and inpatients evacuated during the first six months of Operation Iraqi Freedom as identified in the Cross Tabulation table above. The following information expands on the top five inpatient ICD9 Codes:

<u>ICD9</u>	<u>Description</u>
309.0	Depressive Reaction
550.90	Inguinal Hernia
592.1	Kidney Stones
786.59	Chest Pain
V58.43	Care Following Surgery for Injury or Trauma

The following information expands on the top five outpatient ICD9 Codes:

<u>ICD9</u>	<u>Description</u>
V57.21	Occupational Therapy

V70.50 Armed Forces Med Exam for Service Members
V70.5 Health Exam of Defined Sub Population
V57.1 Physical Therapy
V70.56 Post Deployment Exam

During the cost analyses, the fixed and variable costs were approximated for the evacuation and treatment of one patient for each of these ten ICD9 codes at Landstuhl from March 2003 to August 2003, as well as the fixed and variable costs for moving resources forward in order to treat one of the same patients in the Central Command theater of operation; thus avoiding evacuation. Fixed costs for treatment at Landstuhl Regional Medical Center were comprised of those resources already existing in Germany to treat one patient, while variable costs were comprised of those resources necessary to evacuate one patient. Fixed costs for treatment in Central Command were comprised of those resources already existing in Kuwait to treat one patient, while variable costs were comprised of those resources necessary to treat one patient without evacuating.

Two Graphs of Total Cost follow each narrative in order to determine which treatment scenario is more financially attractive. The first graph demonstrates the costs necessary to reach the minimal state of preparedness for receiving the first patient for each ICD9 Code. The second graph demonstrates the costs necessary to treat ten patients diagnosed with each ICD9 Code over a one-month period. This technique better indicates which scenario is less costly for the long term because the one-time variable costs associated with the initial equipment

purchases necessary to treat the first of each type of patient in the Central Command become fixed costs as the volume of patients increase. Simultaneously, the variable costs associated with evacuation increase as the volume of patients increase.

There were three exceptions to this process; ICD9 Codes V70.5, V70.50, and V70.56. The policy and coding for these three types of health exams experienced significant changes from May to August 2003, making it impractical to compare what it cost for Landstuhl Regional Medical Center to treat these patients versus what it would cost to treat them in the Central Command during the first six months of the war, which was the intent of this analysis. Additionally, although these three ICD9 Codes were within the top five most frequently occurring diagnoses for evacuated outpatients, they were actually a result of evacuation rather than a reason for evacuation. Therefore, they were irrelevant for the purpose of this study. These three codes are discussed in more detail during the Results portion of this research without the use of a Graph of Total Cost.

The remaining seven cost analyses were limited during this research to costs associated with staffing, non-expendable medical equipment uniquely required to treat the diagnosis, air and ground evacuation, and facilities. When analyzing staffing, this research discussed the minimum personnel requirements which must be available to provide support for one patient using three eight-hour shifts per day, 24 hours daily, for one month without consideration for leave or weekends. For the second Graph of

Total Cost, the monthly volume for each ICD9 Code was limited to ten patients despite the fact that each separate diagnosis experienced a different number of evacuees. Limiting each analysis to ten evacuated patients standardized the graphs and best demonstrated the effect a minimal change in volume had on the total cost. Naturally, this is not a normal staffing or patient volume scenario and is not meant to suggest that the minimum requirements are optimal in either the fixed facility or deployed environment. However, these parameters do offer a base level of personnel necessary to provide services for a uniform number of patients in order to assign a fixed cost dollar value for staffing. The same process was applied to the costs associated with the non-expendable equipment uniquely required to treat the diagnosis, facilities, and evacuation. These estimates also reflect the base level of preparedness necessary to treat the first patient diagnosed with each ICD9 Code.

In some cases, there were no exact estimates available. Specifically, ground evacuation costs from Ramstein Air Base to Landstuhl Regional Medical Center were identified using the commercial ambulance rate charged by a local national ambulance service for transporting one to two litter patients per trip as well as the commercial bus rates for transporting ambulatory patients capable of sitting up without assistance. Also, facility costs associated with treating patients in Central Command were limited to the cost of purchasing additional temper tents, metallic shelters and environmental control units while existing facility costs at Landstuhl Regional Medical Center

were derived from environmental services performed on a monthly basis. While these are not exact comparisons, they did meet the purpose of this research.

Results

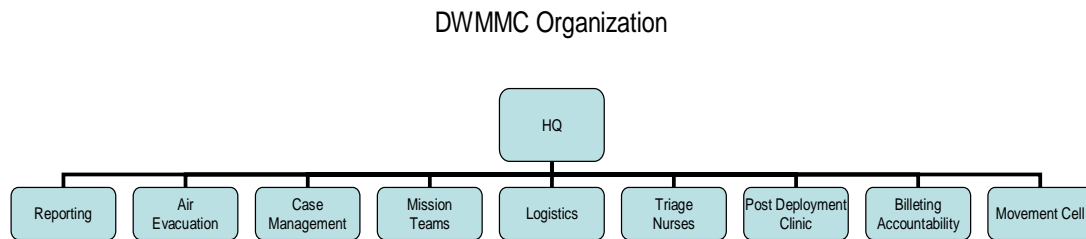
The level of Deployed Warrior Medical Management Center resources necessary to manage a patient varies depending on the patient's primary ICD9 Code diagnosis. Specifically, more resources are needed to manage patients diagnosed with one of the top five outpatient ICD9 Codes than patients diagnosed with one of the top five inpatient Codes. Additionally, the Null Hypothesis was rejected during the Chi-Square statistical analysis. The cost analyses yielded varying results. As mentioned above, three of the top five outpatient ICD9 Codes were outliers yielding results that were not applicable to the purpose of this research. They are discussed in depth below. When the remaining seven graphs of Total Cost were evaluated, only two comparisons suggested it was more expensive after ten days to evacuate soldiers to Landstuhl Regional Medical Center for treatment than to push additional resources forward to treat in the Central Command Theater. However, the pattern established by the remaining five comparisons suggests as patient volume increases, evacuating patients to Landstuhl Regional Medical Center for treatment is the most financially expensive scenario.

Required Resources Analysis:

There were nine operational cells identified within the Deployed Warrior Medical Management Center (Figure 4). Each

required different staffing, equipment and facility levels to perform different services for the evacuated patient. On average, this research verified that the organization was receiving a mix of inpatients and outpatients totaling 47 patients per day during the first six months of the war.

Figure 4



During the historical qualitative analysis, it was determined that each cell (Table 2) supports both inpatients and outpatients, with the exception of the Case Management Cell, the Billeting and Accountability Cell, and the Movement Cell. These three cells only manage outpatients. Therefore, eight additional people and 37 additional pieces of equipment are necessary to manage both inpatients and outpatients as opposed to just inpatients. Also noteworthy is the Billeting and Accountability and Mission Teams Cells operate 24 hours daily; therefore the eight hours of work performed per individual for each of these cells are not consecutive work hours. These personnel are working as needed during a 12 to 24 hour shift throughout the day, much as an Administrative Officer of the Day might perform eight hours of actual work during the course of a one-day duty. Similarly, the Billeting and Accountability Cell operates much like a Command of Quarters duty in the barracks,

requiring 16 non-consecutive man hours of work (two people working eight hours each) spread out over a 24 hour period.

Table 2

Staffing							
	Officer	NCO	Specialist	RN	MD	Total	
Reporting Cell	0	1	4	0	0	5	
Air Evacuation Cell	1	1	8	0	0	10	
Case Management Cell	0	0	0	4	0	4	
Mission Teams Cell	0	1	6	0	0	7	
Logistics Cell	0	1	1	0	0	2	
Triage Nurses Cell	0	0	0	2	0	2	
Post Deployment Clinic Cell	0	0	0	1	1	2	
Billeting and Accountability	0	1	1	0	0	2	
Movement Cell	0	2	0	0	0	2	
Grand Total						36	
Equipment and Facilities							
	Computer	Printer	Desk	Chair	File	Container	Total
Reporting Cell	5	3	5	5	3	3	24
Air Evacuation Cell	10	5	10	10	5	5	45
Case Management Cell	4	2	4	4	2	2	18
Mission Teams Cell	7	3	7	7	3	4	31
Logistics Cell	2	1	2	2	2	5	14
Triage Nurses Cell	2	1	2	2	2	2	11
Post Deployment Clinic Cell	2	1	2	2	2	2	11
Billeting and Accountability	2	1	2	2	1	1	9
Movement Cell	2	1	2	2	2	1	10
Grand Total							173

Chi-Square Statistical Analysis:

The following (Table 3) describes the project's raw data and accuracy rates identified during the Chi-Square statistical analysis:

Table 3

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
ICDs * month	2583	100.0%	0	.0%	2583	100.0%

From the total population, the number of observations for each ICD9 Code and each month is largely different from the expected value, suggesting significance (Table 4 and 5).

Table 4

Month			
	Observed N	Expected N	Residual
March	53	430.5	-377.5
April	299	430.5	-131.5
May	296	430.5	-134.5
June	696	430.5	265.5
July	891	430.5	460.5
August	348	430.5	-82.5
Total	2583		

Table 5

ICD9 Code			
	Observed N	Expected N	Residual
309.0	32	258.3	-226.3
592.1	48	258.3	-210.3
550.90	49	258.3	-209.3
V58.43	49	258.3	-209.3
786.59	52	258.3	-206.3
V57.21	109	258.3	-149.3
V70.50	399	258.3	140.7
V70.5	409	258.3	150.7
V57.1	416	258.3	157.7
V70.56	1020	258.3	761.7
Total	2583		

The following outlines the seven step process observed during the Chi-Square test:

Step 1: State the Null and Alternate Hypotheses:

H_0 : The occurrence of the top five ICD9 codes for both inpatients and outpatients during Operation Iraqi Freedom are independent of the first six months of Operation Iraqi Freedom.

H_a : The occurrence of the top five ICD9 codes for both inpatients and outpatients during Operation Iraqi Freedom depend

on the first six months of Operation Iraqi Freedom.

Step 2: Select the Level of Significance:

I set an alpha probability at $\underline{p} = .01$ to determine statistical significance.

Step 3: Determine the Test Distribution to Use:

I used a contingency table based on the Chi-Square probability distribution.

Step 4: Define the Zone of Rejection:

In testing the independence of both variables at a $\underline{p} = .01$ level with 10 rows and 6 columns, the degrees of freedom (df) value equals $(r-1)(c-1)$, or $df = (10-1)(6-1)$. Therefore, the $df = 45$. Using the Chi-Square distribution table found in Sanders and Smidt (2000) Appendix 6, the critical X squared value is 67.3.

Step 5: State the Decision Rule:

I will reject the Null Hypothesis in favor of the Alternate Hypothesis if X squared is greater than 67.3.

Step 6: Compute the Test Statistic:

The following formula (Figure 5) was used for the test statistic, where "O" equals the observed frequency and "E" equals an expected frequency if the Null Hypothesis is true.

Figure 5

$$X^2 = \sum \left[\frac{[O - E]^2}{E} \right]$$

Step 7: Make the Statistical Decision:

As seen in Table 1 and suggested in Table 3, the test

statistic computed in Step 6 exceeded the Chi-Square critical value specified in Step 5 ($2,583 > 67.3$). The Asymptotic Distribution seen below (Table 6) also indicates statistical significance for both the Months and the ICD9 Codes. Therefore, the Null Hypothesis was rejected.

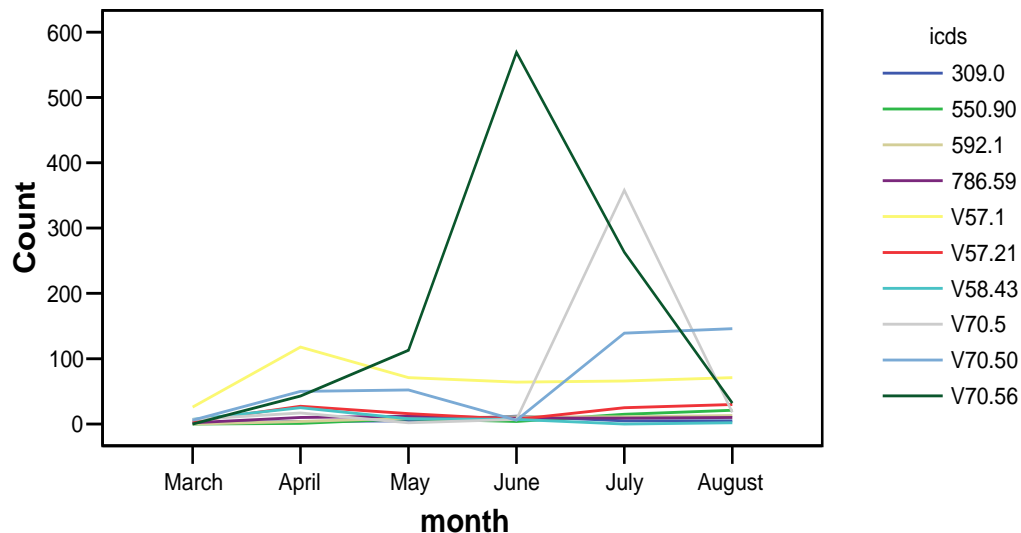
Table 6

Test Statistics		
	Month	ICD
Chi-Square(a,b)	1085.355	3466.760
df	5	9
Asymp. Sig.	.000	.000

Note: a. No cells have expected frequencies less than 5. The minimum expected cell frequency is 430.5.
b. No cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 258.3.

The graph below (Figure 6) represents the cross-tabulation seen in Table 1 above. ICD9 Codes V70.56 (Post Deployment Exam), V70.5 (Health Exam of Defined Sub Population), and V70.50 (Armed Forces Medical Exam for Service Members) were identified as outliers, and will be discussed during the Cost Analyses portion of this project's Results.

Figure 6



Total Cost Analyses:

The first five codes evaluated below are for inpatients and the last two are for outpatients. Itemized figures (Appendix B) applied to the previously outlined methods and procedures were used to determine the fixed and variable costs. The outliers are addressed following the analyses.

ICD9 Code 309.0 (Depressive Reaction Inpatient - 32 occurrences)Fixed Costs for Treatment at Landstuhl Regional Medical Center:

Staffing: Two Psychiatrists, three Nurses with a psychiatric background and three 91X Mental Health Specialists (\$43,602.00).

Non-expendable Medical Equipment: Two Hospital Beds (\$3,174.86).

Facilities: Environmentally servicing existing two patient areas (one male area, one female area), one office area, two latrines, one group discussion area, one storage area, one area for reception and security totaling 1,280 square feet (\$2050.60).

Variable Costs for Treatment at Landstuhl Regional Medical Center:

Air Evacuation: One ambulatory flight evacuation from Central Command's Camp Doha to Ramstein Air Force Base (\$642.00).

Ground Evacuation: One ambulatory ground evacuation from Ramstein Air Force Base to Landstuhl Regional Medical Center (\$23.00).

Fixed Costs for Treatment in Central Command:

Staffing: Two Psychiatrists, three Nurses with a psychiatric background, and three 91X Mental Health Specialists (\$43,602.00).

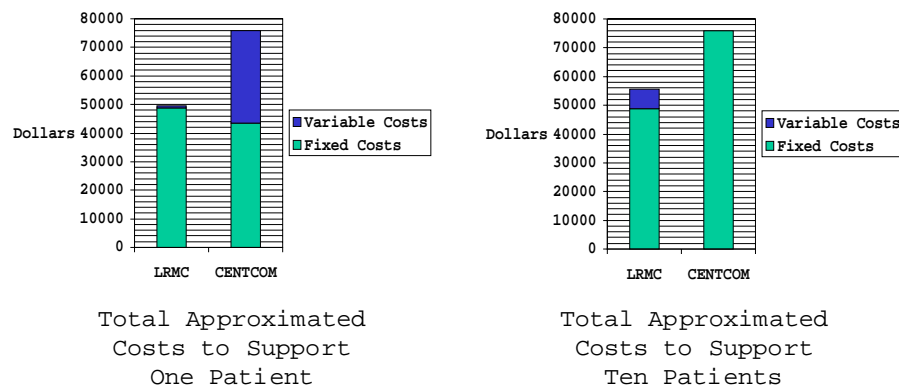
Variable Costs for Treatment in Central Command:

Non-expendable Medical Equipment: Two Field Hospital Beds (\$774.00).

Facilities: Two Temper Tents totaling 1,280 square feet, two Environmental Control Units (\$31,545.00).

Figure 7

Depressive Reaction



ICD9 Code 550.90 (Inguinal Hernia Inpatient - 49 occurrences)

Fixed Costs for Treatment at Landstuhl Regional Medical Center:

Staffing: One Surgeon, one Anesthesiologist, one Operating Room Nurse, and one Operating Room Technician (\$26,985.00)

Non-expendable Medical Equipment: One Operating Room Table, one Surgical Light, one Patient Monitor, one Anesthesia Apparatus, one Respiratory Gas Monitor, one Electrosurgical Unit, one Endoscopic Tower, one Endoscope, one Operating Microscope, one Blood and Fluid Warmer and one Infusion Pump (\$256,551.00).

Facilities: Environmentally servicing existing Operating Room totaling 480 square feet (\$3,765.76).

Variable Costs for Treatment at Landstuhl Regional Medical Center:

Air Evacuation: One litter flight evacuation from Central Command's Camp Doha to Ramstein Air Force Base (\$1,962.00).

Ground Evacuation: One litter ground evacuation from Ramstein Air Force Base to Landstuhl Regional Medical Center (\$414.24).

Fixed Costs for Treatment in Central Command:

Staffing: One Surgeon, one Anesthesiologist, one Operating Room Nurse, and one Operating Room Technician (\$26,985.00)

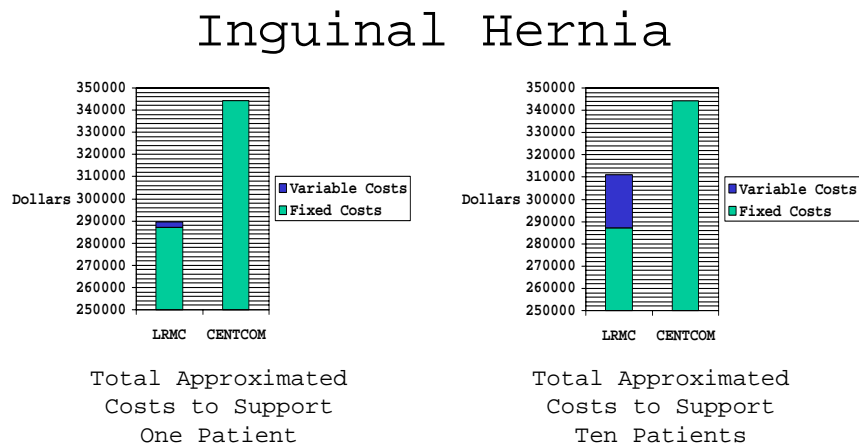
Non-expendable Medical Equipment: One Operating Room Table, one Surgical Light, one Patient Monitor, one Anesthesia Apparatus, one Respiratory Gas Monitor, one Electrosurgical Unit, one Endoscopic Tower, one Endoscope, one Operating Microscope, one Blood and Fluid Warmer and one Infusion Pump (\$256,551.00).

Facilities: Two-sided Expandable International Standard Organization Surgical Suite (\$60,643.00)

Variable Costs for Treatment in Central Command:

None

Figure 8



ICD9 Code 592.1 (Kidney Stones Inpatient - 48 occurrences)

Fixed Costs for Treatment at Landstuhl Regional Medical Center:

Staffing: One Urologist, one Anesthesiologist, one Nurse, and one Operating Room Technician (\$19,185.00).

Non-expendable Medical Equipment: One Homium Laser, one Camera System 4.2, two Elite Durable Flexible Ureteroscopes, two Slimline Semi Rigid Autoclavable Ureteroscopes, one Xenon Light Source (\$102,400.00)

Facilities: Environmentally servicing existing Operating Room totaling 480 square feet (\$3,765.76).

Variable Costs for Treatment at Landstuhl Regional Medical Center:

Air Evacuation: One litter flight evacuation from Central Command's Camp Doha to Ramstein Air Force Base (\$1,962.00).

Ground Evacuation: One litter ground evacuation from Ramstein Air Force Base to Landstuhl Regional Medical Center (\$414.24).

Fixed Costs for Treatment in Central Command:

Staffing: One Urologist, one Nurse, and one Operating Room Technician (\$19,185.00).

Non-expendable Medical Equipment: One Camera System 4.2 and one Xenon Light Source (\$9,400.00)

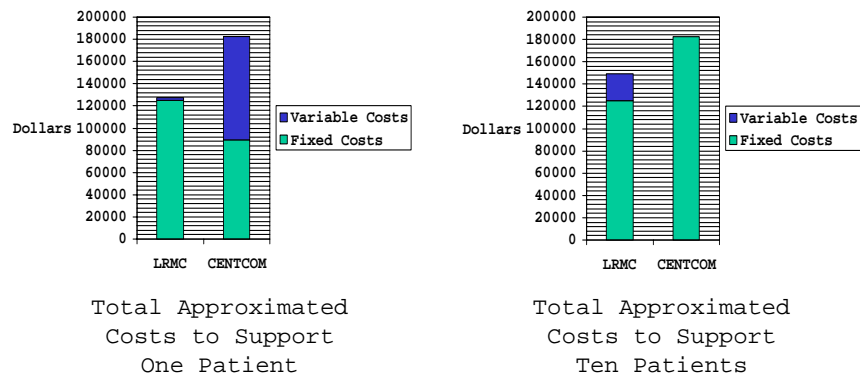
Facilities: Two-sided Expandable International Standard Organization Surgical Suite (\$60,643.00)

Variable Costs for Treatment in Central Command:

Non-expendable Medical Equipment: One Homium Laser, two Elite Durable Flexible Ureteroscopes, two Slimline Semi Rigid Autoclavable Ureteroscopes (\$93,000.00)

Figure 9

Kidney Stones



ICD9 Code 786.59 (Chest Pain Inpatient - 52 occurrences)

Fixed Costs for Treatment at Landstuhl Regional Medical Center:

Staffing: One Physician trained at the Internist Level and two 91W Specialists (\$12,225.00).

Non-expendable Medical Equipment: One Treadmill with Cardiac Monitor (\$24,200.00).

Facilities: Environmentally servicing existing one exam room and one office area totaling 320 square feet (\$512.65).

Variable Costs for Treatment at Landstuhl Regional Medical Center:

Air Evacuation: One litter flight evacuation from Central Command's Camp Doha to Ramstein Air Force Base (\$1,962.00).

Ground Evacuation: One litter ground evacuation from Ramstein Air Force Base to Landstuhl Regional Medical Center (\$414.24).

Fixed Costs for Treatment in Central Command:

Staffing: One Physician trained at the Internist Level, two 91W Specialists (\$12,225.00).

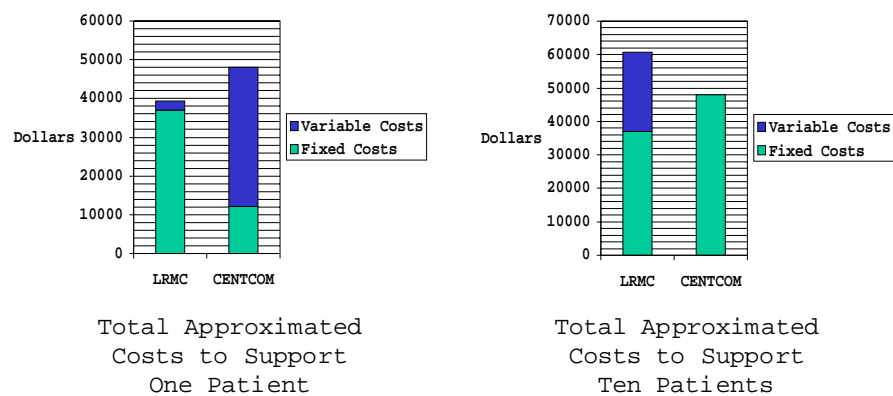
Variable Costs for Treatment in Central Command:

Non-expendable Medical Equipment: One Treadmill with Cardiac Monitor (\$24,200.00).

Facilities: One Half Temper Tent totaling 320 square feet and one Environmental Control Unit (\$11,613.50).

Figure 10

Chest Pain



ICD9 Code V58.43 (Care Following Surgery for Injury or Trauma Inpatient - 49 occurrences)

Fixed Costs for Treatment at Landstuhl Regional Medical Center:

Staffing: One Physician, two Nurses and two 91W Specialist (\$28,519.00).

Non-expendable Medical Equipment: One ECG Machine, one Four Channel Gemini Pump, one ICU Scale Bed, one Kangaroo Pump, one Respiratory Module, one Sequential Compression Device, one Thermometer, one Triple Channel Pump, one Ventilator, one Ventilator Module, one Vital Signs Monitor and one Warming Mechanism (\$74,717.51)

Facilities: Environmentally servicing existing one exam room and one office area totaling 320 square feet (\$2,512.24).

Variable Costs for Treatment at Landstuhl Regional Medical Center:

Air Evacuation: One litter flight evacuation from Central Command's Camp Doha to Ramstein Air Force Base (\$1,962.00).

Ground Evacuation: One litter ground evacuation from Ramstein Air Force Base to Landstuhl Regional Medical Center (\$414.24).

Fixed Costs for Treatment at Central Command:

Staffing: One Physician, two Nurses and two 91W Specialist (\$28,519.00).

Non-expendable Medical Equipment: One ECG Machine, one Four Channel Gemini Pump, one ICU Scale Bed, one Kangaroo Pump, one Respiratory Module, one Sequential Compression Device, one Thermometer, one Triple Channel Pump, one Ventilator, one Ventilator Module, one Vital Signs Monitor and one Warming Mechanism (\$74,717.51)

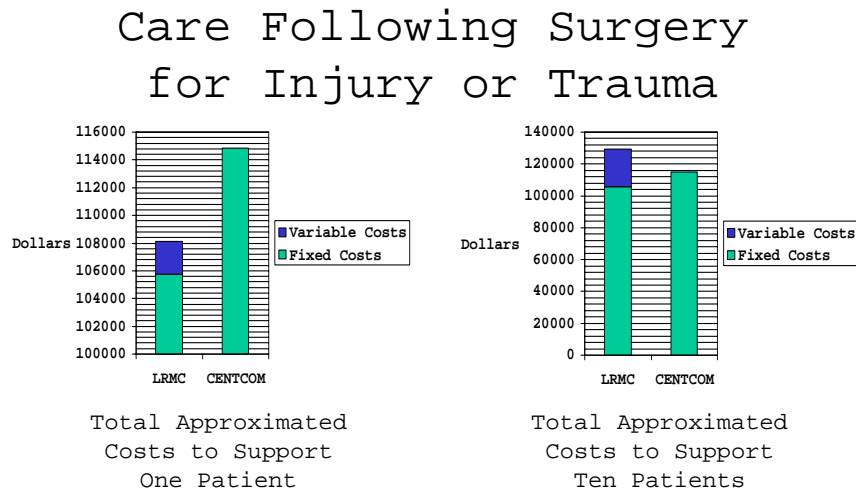
Facilities: One Half Temper Tent totaling 320 square feet

and one Environmental Control Unit (\$11,613.50).

Variable Costs for Treatment in Central Command:

None

Figure 11



ICD9 Code V57.21 (Occupational Therapy Outpatient – 109 occurrences)

Fixed Costs for Treatment at Landstuhl Regional Medical Center:

Staffing: One Occupational Therapist and two 91WN3 Specialists (\$13,759.00).

Non-expendable Medical Equipment: One Splint Forming Machine, one Anvil, and one Work Shelf with Cabinets (\$3,570.00).

Facilities: Environmentally servicing existing one exam room and one office area totaling 640 square feet (\$1,025.30).

Variable Costs for Treatment at Landstuhl Regional Medical Center:

Air Evacuation: One ambulatory flight evacuation from Central Command's Camp Doha to Ramstein Air Force Base (\$642.00).

Ground Evacuation: One ambulatory ground evacuation from Ramstein Air Force Base to Landstuhl Regional Medical Center (\$23.00).

Fixed Costs for Treatment in Central Command:

Staffing: One Occupational Therapist and two 91WN3 Specialists (\$13,759.00).

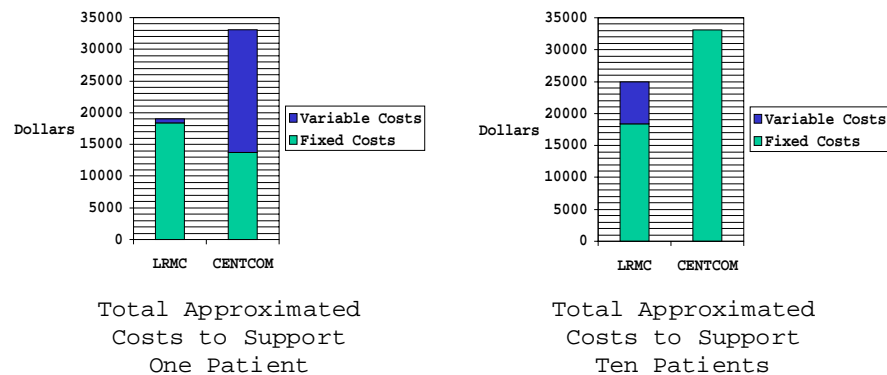
Variable Costs for Treatment in Central Command:

Non-expendable Medical Equipment: One Splint Forming Machine, one Anvil, and one Work Shelf with Cabinets (\$3,570.00).

Facilities: One Temper Tent totaling 640 square feet and one Environmental Control Unit (\$15,727.00).

Figure 12

Occupational Therapy



ICD9 Code V57.1 (Physical Therapy Outpatient - 416 occurrences)

Fixed Costs for Treatment at Landstuhl Regional Medical Center:

Staffing: One Physical Therapist and two 91WN9 Specialists (\$13,759.00).

Non-expendable Medical Equipment: One Ice Machine, one Small Physical Exam Table, one Large Physical Exam Table, one

Exercise Bike, one Upper Body Ergonometer, one Bio Mechanical Ankle Platform, one Cross Trainer, one Leg Press, one Leg Extension, and one Leg Hamstring Extension (\$34,364.69).

Facilities: Environmentally service existing one Physical Therapy Area and one office area totaling 1,280 square feet (\$2050.60).

Variable Costs for Treatment at Landstuhl Regional Medical Center:

Air Evacuation: One litter flight evacuation from Central Command's Camp Doha to Ramstein Air Force Base (\$1,962.00).

Ground Evacuation: One litter ground evacuation from Ramstein Air Force Base to Landstuhl Regional Medical Center (\$414.24).

Fixed Costs for Treatment in Central Command:

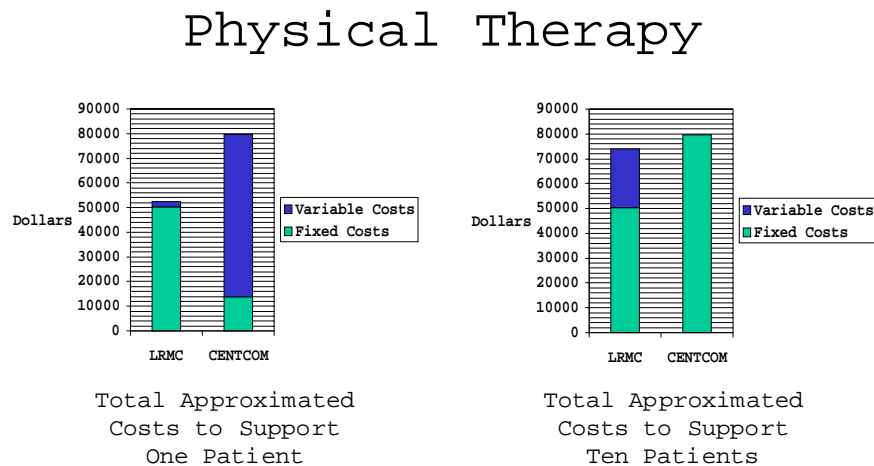
Staffing: One Physical Therapist and two 91WN9 Specialists (\$13,759.00).

Variable Costs for Treatment in Central Command:

Non-expendable Medical Equipment: One Ice Machine, one Small Physical Exam Table, one Large Physical Exam Table, one Exercise Bike, one Upper Body Ergonometer, one Bio Mechanical Ankle Platform, one Cross Trainer, one Leg Press, one Leg Extension, and one Leg Hamstring Extension (\$34,364.69).

Facilities: Two Temper Tents totaling 1,280 square feet, two Environmental Control Units (\$31,545.00).

Figure 13



As mentioned above, a Total Cost analysis was not performed on ICD9 Code V70.5 (Health Exam of Defined Sub Population with 409 occurrences), ICD9 Code V70.50 (Armed Forces Medical Exam for Service Members with 399 occurrences), and ICD9 Code V70.56 (Post Deployment Exam with 1020 occurrences). There are several reasons for this.

The Europe Regional Medical Command directed Landstuhl Regional Medical Center to ensure Post Deployment Exams (see Definitions) were performed on service members prior to returning them to their home duty station. In response to this directive, Landstuhl Regional Medical Center started performing exams on every evacuee in May 2003. Within 30 days, this practice had become impractical. As more patients required post deployment examinations, more physicians were pulled from other duties to perform these services. Further, involving more physicians meant involving departments throughout the hospital not normally associated with physical exams. This led to both a drain in resources as well as various descriptions of Post

Deployment Exams being applied to multiple coding elements. Simultaneously, the practice of performing Post Deployment Exams at Landstuhl Regional Medical Center was determined to be unnecessary because such exams were being performed at the service member's Home Station as well as prior to evacuation from the Central Command Theater of operations.

This is perhaps most clear in Figure 6 above, where in June of 2003 the reader may observe nearly 600 Post Deployment Exams (ICD9 Code V70.56) were performed. This number then drops to less than 300 in July 2003 when Health Exams of Defined Sub Populations (ICD9 Code V70.5) simultaneously made a dramatic climb to a near equal 300 occurrences. This suggests that the latter exams were merely the remaining approximate 300 Post Deployment Exams being incorrectly coded as ICD9 V70.5 by another provider coding element within the hospital. Further, ICD9 Code V70.5 is not a proper diagnosis code for soldiers returning from Operation Iraqi Freedom. When correctly utilized, ICD9 V70.5 is a Title Code not meant to identify an actual diagnosis since it is lacking a Department of Defense modifier in the second decimal space. And finally, most of the providers identified in the Composite Healthcare System responsible for performing these additional exams were not permanently assigned to Landstuhl Regional Medical Center, creating more room for transcription and coding errors.

By July of 2003, the Europe Regional Medical Command's rightful intent of each service member receiving a Post Deployment Medical Examination prior to completion of

redeployment was being met at healthcare activities other than Landstuhl Regional Medical Center; such as the Combat Support Hospital in Kuwait, as well as fixed facilities in the Continental United States. This caused both ICD9 Codes to dip below 50 by August 2003, compounding the difficulty of an accurate cost analysis. Because the coding methods and directives surrounding these exams were demonstrably confusing, a cost analysis would likely lead to unfounded conclusions. They were therefore eliminated from the cost analysis process.

Similarly, between July and August 2003, Armed Forces Medical Exams for Service Members increased dramatically. Because this spike occurred during the same time period the other two medical exams were experiencing questionable changes, it is reasonable to assume a cost analysis of any type of physical exam during this phase of the war could likely lead to unfounded conclusions. The remaining ICD9 Code identifying this final form of a physical was therefore eliminated from the cost analysis process.

Discussion

The interpretation of this research is best discussed by addressing the three principal results as they relate to the purposes of this project. In short, outpatients evacuated to Landstuhl Regional Medical Center from Operation Iraqi Freedom required more resources to manage their care, and the month of evacuation was a predictor of how many outpatients would arrive. Further, the number of patients evacuated could possibly have been lessened in some cases by placing key equipment and

personnel in the Central Command Theater. This research suggests that such a maneuver might even be less financially costly. Therefore, any Table of Distribution and Allowances organization established to manage evacuated patients could be tailored to a higher degree of accuracy. For instance, a Deployed Warrior Medical Management Center established at Landstuhl Regional Medical Center for any future conflict could use the results and structure of this research as a format to estimate the pieces of equipment, space, and people it will need to manage inpatients versus outpatients for each month during the first 180 days of hostilities. Additionally, leaders for such an organization could use this template to better predict their required resources by determining what medical treatment assets will be positioned in the Central Command and what assets will remain in the European Command. The three principal results of this research suggest that a Table of Distribution of Allowances would better serve its purpose if it were scalable throughout the conflict.

The results of the historical qualitative analysis revealed three of the nine operational cells in the current Deployed Warrior Medical Management Center support outpatients only. Even with a deliberately minimized model of resources necessary to manage patients for one day, this research demonstrated that managing outpatients required significantly greater levels of staffing and equipment. Closely related to these findings was the statistical analysis which suggested the months of Operation Iraqi Freedom predicted the likelihood of an ICD9 Code's

occurrence. Simply stated, there were fewer outpatients during the first three months of the war compared to the fourth, fifth and sixth months. Because ICD9 Code diagnoses help to determine a patient's status as either inpatient or outpatient, leaders would do well to reserve outpatient medical management assets during the first quarter of a conflict, or use those assets elsewhere until they are needed to mobilize on short notice for surges.

The face values observed during the cost analyses at first seem less persuasive. However, there are expense patterns that impact the development process and suggest need for a separate Table of Distribution and Allowances organization. For example, the three outlier ICD9 Codes that were eliminated from the analysis are helpful in their own right. The energy devoted to conducting Post Deployment Medical Examinations at a time when resources were already scarce was exhaustive. These findings should caution leaders when planning the structure of a Deployed Warrior Medical Management Center. A lack of overall preparation between two separate command elements led to duplicity of effort, coding error, and a waste of resources. This human and monetary capital would have been better utilized elsewhere.

Of the remaining seven ICD9 Codes, only two analyses display a higher dollar value when sending patients to Landstuhl Regional Medical Center for treatment as opposed to treating them in the Central Command Theater. However, the structure of this cost analysis must be considered more closely for an

improved interpretation of the results. First, the costs identified for this study were not far-reaching. In limiting the research to merely four types of expense, the analysis is limited in scope. Secondly, the pre-supposed scenario of treating only ten patients within a single month with minimal assets is only distantly related to what actually occurred. And finally, the variable costs were deliberately restricted to focus on evacuation fees and initial equipment purchases, which are certainly not the only variables to consider when determining the true total balance.

However, even with these limitations, there are patterns across the seven figures suggesting that with the passage of time it becomes more financially costly to evacuate patients to Landstuhl Regional Medical Center for treatment. With each comparison, the variable costs increase with patient volume for treatment at Landstuhl Regional Medical Center due to evacuation fees. Conversely, variable costs decrease in Central Command after the initial equipment purchases are converted to fixed costs. Given this rudimentary approach, it seems the only difference between treating patients in Central Command versus treatment at Landstuhl Regional Medical Center is the difference between initial equipment purchases and evacuation.

Naturally, considerations for treatment go well beyond the simplistic format of this total cost analysis. Quality of care, extended care, repatriation, psychological impact and politics are only a few of the variables not addressed in this research which would have a colossal effect on where patients ought to

receive treatment. Additionally, the Department of Defense is continually reviewing Medical Regulating practices. Recently, Through Regulation initiatives have been put forth, which would theoretically allow a better evacuation match between the patient and the receiving medical treatment facility, regardless of geographic proximity. Through Regulation would allow the prescribing physician in the Central Command Theater of Operations to determine the evacuation location of the patient, depending on the patient's needs. In other words, if a physician located in a Combat Support Hospital in Iraq determines it is medically appropriate and feasible to fly a patient directly to Walter Reed Army Medical Center in Washington, D.C., that physician can order the evacuation of the patient from Iraq directly to the United States via military or commercial air evacuation, bypassing Landstuhl Regional Medical Center altogether. This initiative alone serves as a confounding variable that would clearly impact the level of resources necessary to build an effective Table of Distribution and Allowances organization designed to receive patients at Landstuhl because more patients would be sent directly to the Continental United States for treatment instead of Germany. Still, there are patterns within this research that suggest that in some cases, it is potentially more costly to evacuate patients for treatment.

Conclusions and Recommendations

The main question this research hoped to answer was does the Department of Defense need to establish a separate Table of

Distribution and Allowances organization resembling the current Deployed Warrior Medical Management Center at Landstuhl Regional Medical Center to maintain our Military Healthcare System's quality of care overseas throughout the Global War on Terrorism? Yes, such an organization is necessary.

Because this research provides evidence in patient volume, time, acuity, and cost that supports the need for a separate organization, it should be used to assist in the development of a Deployed Warrior Medical Management Center Table of Distribution and Allowances for Landstuhl Regional Medical Center. This will provide a positive impact on the Department of Defense's continuing efforts to improve medical management. The personnel, equipment and facility authorizations and levels of availability should be scalable over time and tailored to the needs of healthcare throughout the different phases of any future conflict. The research methods used throughout this project should be employed as templates for further research to determine patterns evolved since August of 2003. The continuation and refinement of these tools will enhance Landstuhl Regional Medical Center's ability to develop the Deployed Warrior Medical Management Center, and the Department of Defense's capability to provide healthcare to its most valuable asset.

Appendix A

Definitions

Deployed Warrior Medical Management Center: A team unique to Landstuhl Regional Medical Center designed in response to the Global War on Terrorism to provide the initial reception, triage, assessment, treatment, case management and accountability for evacuated patients, and facilitate their re-integration into the theater or garrison environment, addressing as appropriate current and future quality of life issues.

Post Deployment Exam: A health physical specifically designed to examine the unique needs of military members returning from war. These members may have experienced severe physical or psychological trauma resulting from combat, environmental extremes, illness or infectious disease, and weapons of mass destruction. Female military members may have sustained urinary tract and fungal infections, an unplanned pregnancy, or perhaps a sexual assault that may impact their reproductive future. The Post Deployment Exam helps to identify these medical conditions prior to returning to duty or the Continental United States.

Marginal Cost: The change in the total cost of an evacuation mission by adding one more patient to the manifest.

Economic Cost: The amount of money Landstuhl Regional Medical Center paid for this piece of equipment.

Non-expendable Equipment: Equipment requiring formal accountability per AR735-5.

Medical Regulating: Casualty management system designed to coordinate the movement of patients from the site of injury or onset of disease through successive echelons of medical care to medical treatment facilities that can provide appropriate levels of medical treatment.

Appendix B

Individual Costs Used During Cost Analysis

Non Expendable Equipment Costs:

	Qty (ea)	Economic Cost	Source
Anesthesia Apparatus	1	\$ 500.00	LRMC Property Book
Anvil	1	\$ 500.00	LRMC Property Book
Bio Mechanical Ankle Platform	1	\$ 5,800.00	LRMC Property Book
Blood and Fluid Warmer	1	\$ 5,408.00	LRMC Property Book
Camera System 4.2 NTSC or PAL	1	\$ 12,432.49	LRMC Property Book
Cross Trainer	2	\$ 27,000.00	LRMC Property Book
ECG Machine	1	\$ 2,825.57	LRMC Property Book
Electrosurgical Unit	1	\$ 387.00	LRMC Property Book
Elite Durable Flexible Ureteroscope	1	\$ 1,587.43	LRMC Property Book
Endoscope	1	\$ 5,223.54	LRMC Property Book
Endoscopic Tower	1	\$ 53,000.00	LRMC Property Book
Exercise Bike	1	\$ 3,177.40	LRMC Property Book
Field Hospital Bed	1	\$ 3,814.98	LRMC Property Book
Fixed Facility Electric Hospital Bed	1	\$ 570.00	LRMC Property Book
Four Channel Gemini Pump	1	\$ 2,455.00	LRMC Property Book
Homium Laser	1	\$ 2,211.16	LRMC Property Book
Ice Machine	1	\$ 5,905.24	LRMC Property Book
ICU Scale Bed	1	\$ 5,865.41	LRMC Property Book
Infusion Pump	1	\$ 2,727.93	LRMC Property Book
Kangaroo Pump	1	\$ 1,633.00	LRMC Property Book
Leg Extension	1	\$ 1,202.06	LRMC Property Book
Leg Hamstring	2	\$ 13,000.00	LRMC Property Book
Leg Press	1	\$ 33,500.00	LRMC Property Book
Operating Microscope	1	\$ 1,820.00	LRMC Property Book
Operating Room Table	1	\$ 1,250.00	LRMC Property Book
Patient Monitor	1	\$ 583.21	LRMC Property Book
Physical Therapy Table (Large)	1	\$ 24,200.00	LRMC Property Book
Physical Therapy Table (Small)	1	\$ 6,900.23	LRMC Property Book
Respiratory Gas Monitor	1	\$ 3,288.98	LRMC Property Book
Respiratory Module	1	\$ 28,500.00	LRMC Property Book
Sequential Compression Device	1	\$ 4,808.00	LRMC Property Book
Slimline Semi Rigid Ureteroscope Autoclavable	1	\$ 7,250.00	LRMC Property Book
Sonosite Echocardiograph with Transducer	1	\$ 1,800.00	LRMC Property Book
Splint Forming Machine	1	\$ 3,600.00	LRMC Property Book
Splint Work Shelf with Cabinets	1	\$ 27,620.00	LRMC Property Book
Surgical Light	1	\$ 12,823.00	LRMC Property Book
Thermometer	1	\$ 15,000.00	LRMC Property Book
Treadmill with Cardiac Monitor	1	\$ 36,114.00	LRMC Property Book
Triple Channel Pump	1	\$ 26,313.00	LRMC Property Book
Upper Body Ergonometer	1	\$ 6,781.00	LRMC Property Book
Ventilator	1	\$ 51,000.00	LRMC Property Book
Ventilator Module	1	\$ 25,000.00	LRMC Property Book
Vital Signs Monitor	1	\$ 47,000.00	LRMC Property Book
Warming Mechanism Bare Hugger	1	\$ 6,600.00	LRMC Property Book
Xenon Light Source	1	\$ 2,300.00	LRMC Property Book

Facility Costs:

	Qty (ea)	Economic Cost	Source
Extendable Modular Personnel Temper Tent (640 sq ft)	1	\$ 8,227.00	GSA Schedule
Two-Sided Expandable ISO Surgical Suite	1	\$ 60,643.00	Federal Logistics Catalog
MOB 250 Environment Control Unit A/C and Heat	1	\$ 7,500.00	GSA Schedule
	Months	Economic Cost	Source
Environmental Services for (640 sq ft) Fixed Vital	1	\$ 5,024.47	AHS, Inc., Contract
Environmental Services for (640 sq ft) Fixed Ancillary	1	\$ 1,025.30	AHS, Inc., Contract

Staffing Costs:

	Months	Average Pay	Source
91D SGT/EF with COLA and BAH	1	\$ 4,425.00	Military Standard Pay Table
91W SGT/E5 with COLA and BAH	1	\$ 4,425.00	Military Standard Pay Table
91WN3/9 SGT/E5 with COLA and BAH	1	\$ 4,425.00	Military Standard Pay Table
91X SGT/E5 with COLA and BAH	1	\$ 4,425.00	Military Standard Pay Table
MD CPT/O3 with Professional Pay, COLA and BAH	1	\$ 7,800.00	Military Standard Pay Table
MD MAJ/O4 with Professional Pay, COLA and BAH	1	\$ 9,851.00	Military Standard Pay Table
Occupational Therapist 1LT/O1 with COLA and BAH	1	\$ 4,909.00	Military Standard Pay Table
Physical Therapist 1LT/O1 with COLA and BAH	1	\$ 4,909.00	Military Standard Pay Table
RN 1LT/O1 with COLA and BAH	1	\$ 4,909.00	Military Standard Pay Table

Evacuation Costs:

		Marginal Cost	Source
Air Evac from Kuwait to Germany (Ambulatory)	1	\$ 642.00	DoD Airlift Rates
Air Evac from Kuwait to Germany (Litter)	1	\$ 1,962.00	DoD Airlift Rates
Ground Evac from Ramstein to Landstuhl (Ambulatory)	1	\$ 23.00	Transportation Command
Ground Evac from Ramstein to Landstuhl (Litter)	1	\$ 414.24	Deutsches Rotes Kreuz

Notes:

1. Ground evacuation from Ramstein to Landstuhl for a litter patient is the commercial rate for the Deutsches Rotes Kreuz local national ambulance service for ambulance transportation. This cost does not include the costs incurred when a physician is necessary for transport, nor does it include the costs incurred for transportation at night or on a German holiday. The marginal cost above is taken from 298.82 euros for the cost of the ambulance plus an additional 2.53 euros per kilometer (15 k from Ramstein to Landstuhl) converted to dollars at an exchange rate of \$.76 dollars for \$1.00 euros (the exchange average from 12 to 16 January 2004).
2. Ground evacuation from Ramstein to Landstuhl for an ambulatory patient is the contract rate to support one 44 passenger bus with one driver and one technician. This cost does not include medical care enroute. This cost also assumes each passenger is capable of sitting up and the bus is full to capacity.
3. Environmental services for a fixed facility is listed twice; once for the cost of cleaning vital patient care areas and once for the cost of cleaning ancillary areas. Both figures are taken from the Aseptic Housekeeping Services, Inc. contract between the government and Landstuhl Regional Medical Center. That contract calls for vital areas to be cleaned 21.67 times per month at \$3.91 per square meter and for ancillary areas to be cleaned 13 times per month at \$1.33 per square meter. For the purposes of this research, one square meter equals 10.8 square feet. 640 square feet was used as a base-level for the cleaning cost and economic cost of one 32 foot by 20 foot temper tent.

References

- Adams, M. S. (1996). Pre-existing disease in British Army patients aeromedically evacuated from the former Republic of Yugoslavia. *Journal of the Royal Army Medical Corps*, 142(3), 97-100.
- Anonymous. (2002). Reports say diversion on the rise: use technology to overhaul patient flow. *Ed Management*, 14(3), 25-7.
- Bilski, T. R., Baker, B. C., Grove, J. R., Hinks, R. P., Harrison, M. J., Sabra, J. P., Temerlin, S. M., & Rhee, P. (2003). Battlefield casualties treated at Camp Rhino, Afghanistan: lessons learned. *Journal of Trauma-Injury Infection and Critical Care*, 54(5), 814-21.
- Bouman, J. H., Schouwerwou, R. J., Van der Eijk, K. J., van Leusden, A. J., & Savelkoul, T. J. (2000). Computerization of patient tracking and tracing during mass casualty incidents. *European Journal of Emergency Medicine*, 7(3), 211-6.
- Chernof, B., Hilborne, L., Heckman, M., Esquivel, M., & Guterman, J. J. (1995). The link between the department of pathology and laboratory medicine and medical administration: managing the quality continuum. *American Journal of Clinical Pathology*, 103(4 Suppl 1), 24-9.
- Cooper, D. R., & Schindler, P. S. (2001). *Business research methods* (7th ed.). New York: McGraw-Hill Irwin.
- Driscoll, R. S. (2001). *New York Chapter History of Military Medicine Award. U.S. Army medical helicopters in the Korean*

- War. Military Medicine, 166(4), 290-6.
- Finkler, S. A., & Ward, D. M. (1999). Essentials of cost accounting for health care organizations (2nd ed.). Gaithersburg, Maryland: Aspen Publishers, Inc.
- Gapenski, L. C. (2001). Understanding healthcare financial management (3rd ed.). Chicago: Health Administration Press.
- Lane, D. S., & Ross V. (1998). Defining competencies and performance indicators for physicians in medical management. American Journal of Preventive Medicine, 14(3), 229-36.
- Lukish, J. R., Gill, G. G., & McCoy, T. R. (2001). Surgical care in the isolated military hospital. Military Medicine, 166(1), 90-3.
- Newmark, J., & France, L. O. (1998). Use of medical specialties in medical operations other than war: lessons from Saudi Arabia. Military Medicine, 163(5), 278-82.
- Rosenberg, B. L., Butz, D. A., Comstock, M. C., & Taheri, P. A. (2003). Aeromedical service: how does it actually contribute to the mission?. Journal of Trauma-Injury Infection and Critical Care, 54(4), 681-688.
- Sanders, D. H., Smidt, R. K. (2000). Statistics, A First Course, 6th Edition. Pages 480-517, and Appendix 6.
- Schultz, C. H., Koenig, K. L., & Lewis, R. J. (2003). Implications of hospital evacuation after the Northridge, California, earthquake. New England Journal of Medicine, 348(14), 1349-55.
- Szilard, I., Cserti, A., Hoxha, R., Gorbacheva, O., & O'Rourke,

- T. (2002). International Organization for Migration: experience on the need for medical evacuation of refugees during the Kosovo crisis in 1999. *Croatian Medical Journal*, 43(2), 195-8.
- Wood, T. J., Scally, G., & O'Neill, D. (1995). Management knowledge and skills required by U.K. and U.S. medical directors. *Physician Executive*, 21(8), 26-9.